National Research Council Canada
Conseil national de recherches Canada

THE U.N. CONFERENCE ON NEW AND RENEWABLE ENERGY SOURCES
SUMMARY OF THE PROCEEDINGS AND DOCUMENTATION RELATING TO FUELWOOD AND CHARCOAL

BY

SUSAN BOGACH

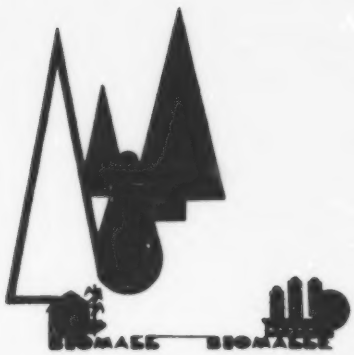
DIVISION OF ENERGY RESEARCH AND DEVELOPMENT

OTTAWA

NRCC 19867

THE U.N. CONFERENCE ON NEW AND RENEWABLE ENERGY SOURCES
SUMMARY OF THE PROCEEDINGS AND DOCUMENTATION RELATING TO FUELWOOD AND CHARCOAL

By Susan Bogach



A report produced for the
National Research Council and
Forestry Services of Environment Canada

December 1981

This report was prepared for the Division of Energy Research and Development of the National Research Council under a Personal Service contract. It has been edited and reproduced from copy supplied by the contractor, Susan Bogach of Van Meurs and Associates Ltd. of Ottawa, Ontario.

Project Manager: Ross Silversides, NRC

Copies may be purchased from:

1. NRC Publications, Ottawa, Canada. K1A 0R6

NRCC # 19867 Price:

PREFACE

"Nearly half the world's population - 2 billion people - depend on fuelwood, charcoal, animal dung and agricultural waste for cooking."

"More than one hundred million people cannot obtain enough fuelwood for their cooking needs, while an additional billion people are affected by shortages. If present trends continue, over 2.5 billion pople will need to be provided with alternative fuels by the year 2000."

Very simply and forcefully, this describes one of the major energy problems in the developing world. Clearly, there is much to be done in forest management throughout the world in response to not only the need for wood as fuel but also for timber and pulp and paper. The situation is critical, whether we are faced with "silvicultural slums" in Canada or desertification in Africa. Our response has to be expressed with greatly intensified afforestation/reforestation programs and much better use of available resources to blunt the effect of past inaction.

This is the message brought home to us in this contractor's report from the U.N. Conference on New and Renewable Energy. Unfortunately, it also reveals that platitudes come easier than action. Little was achieved in terms of solid action and commitment of funds. The report relays information on the conference's significant events relating to wood fuel and charcoal and in its last chapter presents the appraisal by the contractor.

Bioenergy R&D Program
Division of Energy R&D
National Research Council

PREFACE

"Près de la moitié de la population mondiale, soit deux milliards de personnes, se sert du bois, du charbon, des déjections solides animales et des résidus agricoles pour cuire ses aliments".

"Plus de cent millions d'individus ne peuvent pas se procurer assez de bois pour leurs besoins de cuisson, tandis que près d'un milliard d'autres personnes souffrent d'une pénurie de combustibles. Si la tendance se maintient, plus de 2,5 milliards d'habitants de notre globe devront être alimentés en combustibles de remplacement d'ici l'an 2000".

Les citations ci-dessus décrivent très simplement mais avec force, les problèmes énergétiques les plus pressants rencontrés par les pays en voie de développement. Il est clair qu'il reste beaucoup à faire dans les domaines de l'exploitation forestière pour répondre non seulement aux besoins de bois utilisé comme combustible, mais aussi pour la construction et la production de pâtes et papiers. La situation demeure critique, quelle soit considérée sous l'angle des "taudis sylvicoles" du Canada ou de l'érosion des sols en Afrique. Notre action doit se traduire par la mise en place d'un programme intensif et une bien meilleure utilisation des ressources disponibles pour contrecarrer les effets de l'inaction passée.

Il s'agit du message qui nous est transmis, dans ce rapport de l'entrepreneur, par la conférence des Nations-Unies sur les énergies nouvelles et renouvelables. Le rapport montre malheureusement qu'il est plus facile d'élaborer de vaines formules que de passer aux actes. Peu de choses ont été faites en termes de mesures concrètes et d'engagements financiers. Le rapport renseigne sur les événements marquants de la conférence en ce qui a trait au bois et au charbon et présente, dans son dernier chapitre, l'évaluation de l'entrepreneur.

Programme de recherche et développement
bioénergétiques
Division de la recherche et du développement
énergétiques
Conseil national de recherches du Canada

TABLE OF CONTENTS

		Page
	PREFACE/PRÉFACE	i,ii
	TABLE OF CONTENTS	iii
1.	THE ORIGINS OF THE CONFERENCE	1
2.	THE ORGANIZATION OF THE CONFERENCE	1
3.	SUMMARY OF THE CONFERENCE PROCEEDINGS WITH RESPECT TO FUELWOOD AND CHARCOAL	
	3.1 The General Debate	2
	3.2 Formulation of a Plan of Action	2
	3.3 Institutional and Financial Arrangements	5
	3.4 Comments on the Forum Sessions at the Conference	8
4.	A SUMMARY OF CONFERENCE DOCUMENTATION WITH RESPECT TO WOOD ENERGY	9
	4.1 Summary of the Report of the Technical Panel on Fuelwood and Charcoal in its Second Session	14
	4.2 Summary of References to Wood Energy in the National Reports	14
	4.3 A List of Conference Documentation	16
	4.3.1 Fuelwood Related	26
	4.3.2 General Documentation	26
	4.4 Abstracts of Major Documents Available at the UN Conference on New and Renewable Energy Sources in Relation to Fuelwood and Charcoal	28
5.	AN OBSERVER'S APPRAISAL OF THE CONFERENCE	29
	5.1 Introduction	32
	5.2 Objectives of the Conference	32
	5.3 The Exchange of Experience and Information	33
	5.4 The Creation of Awareness	34
	5.5 The Plan of Action	36
	5.6 Institutional Arrangements and Financing	38
	5.7 Summary	38
		40

1. THE ORIGINS OF THE CONFERENCE

The General Assembly of the U.N. decided to convene a Conference on new and renewable sources of energy in 1978. The Assembly indicated the need to develop new and renewable sources of energy in order to meet requirements for continued economic and social development, especially in the developing countries. It also expressed awareness of the progress in recent years with regard to technologies for the development and use of new and renewable sources of energy. The resolution passed by the General Assembly pointed to the need to exchange information on the latest developments and experience in the practical application of new and renewable sources of energy.

The objective of the Conference was defined as "elaborating measures for concerted action designed to promote the development and utilization of new and renewable sources of energy, with a view to contributing to meeting future overall energy requirements, especially those of the developing countries, in particular in the context of efforts aimed at accelerating the development of the developing countries."

According to the Secretary General of the Conference, Enrique Iglesias, the purpose of the Conference was to create a worldwide climate that will pave the way for accelerated development of alternatives to fossil fuels.

The Conference examined 14 alternate sources of energy - solar energy, biomass energy, wind power, hydropower, fuelwood and charcoal, geothermal energy, ocean energy, oil shale and tar sands, peat, and the use of draught animals for energy purposes. Part of the preparatory work for the Conference included the preparation of technical reports on each source of energy by technical panels and consultants. These studies provided the technical background to the discussions of the Conference in Nairobi that were aimed at developing a "Program of Action", nationally and internationally.

2. THE ORGANIZATION OF THE CONFERENCE

The Conference officially opened Monday, August 10, 1981 at the Kenyatta Conference Center in Nairobi. On the first day, the Conference heard opening statements and dealt with procedural questions. On the second day, the general debate began and continued

through the 18th of August. Two main committees were set up to consider and draft the Program of Action which was to include a plan of action along with methods to fund it and mechanisms to oversee its implementation.

Several panels, organized by U.N. Agencies in co-operation with the Conference Secretariat, were held on such topics as energy and the environment, energy and industry, and energy and agriculture.

A parallel Non-Governmental Organization Forum was held from August 9 to August 16, 1981 with panels, round tables and workshops including a round table discussion on fuelwood.

Debate on the Program of Action forwarded by the two Committees was to have been held on August 19, 20 and 21. However, because one of the Committees failed to come to an agreement, debate on the program was postponed until August 21 when a decision was taken with regard to the issues discussed at the Conference.

3. SUMMARY OF THE CONFERENCE PROCEEDINGS WITH RESPECT TO FUELWOOD AND CHARCOAL

3.1 The General Debate

The General Debate heard speakers from member nations of the U.N. and representatives of U.N. and other intergovernmental agencies. Most speakers emphasized the need for a transition to energy sources other than fossil fuels. Many of the speakers held out strong hope for a major role for new and renewable sources of energy (NRSE), while cautioning that in the near future their role will be limited.

Many of the speakers from developing countries stressed their concern with obtaining adequate supplies of conventional fuels, especially oil, in the near term. The tone was set by the opening address of President Moi of Kenya who said that the development of the poor countries would require an ever increasing deployment of energy and that the international community must ensure access to energy resources to those countries. Some of these countries were spending over fifty percent of their foreign exchange earnings on oil imports. He said that their situation should receive some attention during the Conference. The attitude of many of the developing countries was most strongly stated by the Industry Minister of Zimbabwe in his address to the Conference.

"However, Zimbabwe is deeply concerned that new and renewable sources of energy should not be made the energy of the poor countries leaving the conventional sources to satisfy the insatiable appetites of the industrialized countries who already consume an immorally disproportionate quantity of the world's energy sources."

The Prime Minister of Jamaica expressed his opinion on the Conference. Whether the Conference achieved its purpose or failed depended upon three basic decisions: firstly, that the Conference specifically decides to identify and promote a mechanism to aid research and development in new and renewable sources of energy and to promote new technology to reach the international market place; secondly, that it specifically decide to determine the mechanism of financing the requirement for research and development and implementation...; and last, that it decide to act on these specifics now and that the Conference not be allowed to taper into any device which rested on the summoning of yet another conference and doing only a part now of what this Conference had been called to do.

This attitude reflected that of many of the members of the Group of 77 ran counter to the objectives of many of the industrialized countries at the Conference. The U.S. position, followed by Japan, Canada and the ECIO was that no new mechanisms needed to be devised to promote research and development or implementation in the area of new and renewable energy sources; this could be done within the current multilateral and bilateral aid system. Also, no new allocations of funds were necessary. Or, at best, such funds should be made available on a voluntary basis.

Prime Minister Trudeau, opening the Second Day of the Conference, pledged to increase Canadian bilateral and multilateral assistance programs for renewable energy through:

- a $10 million increase (over 5 years) in support for energy research related to and conducted in developing countries through Canada's International Development Research Center,
- initial capital of $5 million to encourage private companies to adapt new energy technologies to development needs,
- $25 million to alleviate "a particular need of African countries, especially the Sahel region... in addition to funds already projected for bilateral assistance,

- creation of Petro-Canada International to assist (either directly or as an executing agent for other agencies such as the World Bank) oil importing countries to exploit their own energy resources, particularly hydrocarbons,
- support for the creation of an Energy Affiliate to the World Bank.

These contributions were designed to help developing countries to "develop their energy resources, to grow more food, to retard the depletion of scarce forest resources being used for fuel and to hold back what Mrs. Ghandi vividly described as the deathly march of the desert."

The Director General of the OPEC Fund for International Development stated that the members of OPEC had declared their willingness to support the energy account of UNDP through the OPEC Fund and were willing to expand their contribution to tht account should others be prepared to do so. In addition, he referred to a proposal for the establishment of an OPEC Development Bank with an initial capital of $25 billion.

Many of the speakers in the General Debate emphasized the importance of the fuelwood problem - these speakers included representatives of Sweden, Japan, Botswana, Canada, China, Sudan, India, Niger, Nepal, Belgium, Rwanda and of organizations such as FAO, UNEP, U.N. University, and the U.N. Center for Human Settlements.

Their statements emphasized the importance of actions to ensure energy for basic survival, with emphasis on rural populations. The need for afforestation and reforestation programs along with a more efficient use of woodfuel were frequently mentioned.

On the second day of the Conference, a Fuelwood March was organized to dramatize the situation of fuelwood supplies. International NGO's along with Kenyan NGO's and hundreds of private citizens participated in the march which was led by the Secretary-General of the Conference, Mr. Enrique Iglesias, the President of the Conference and Minister of Energy for Kenya, John Henry Okwanyo, and Wangare Maathai, a member of the Executive Council of the Women of Kenya. The marchers were met by U.N. Secretary General Kurt Waldheim and by the Prime Ministers of Canada, Jamaica and Sweden. In response to the March, U.N. Secretary General Waldheim said that fuelwood

shortages were not only an economic problem, but a political one that threatened the very stability of the world.

However, there was a basic problem in considering action to remedy fuelwood shortages in the Third World. This problem can be seen in the quote from the Zimbabwe delegate above. Developing countries have to balance carefully the energy needs of their industrial sector for petroleum and the needs of the traditional sector for fuelwood and charcoal. While accepting the seriousness of rural energy problems, they were concerned that rural energy priorities should not be met at the expense of industrialization efforts. Since supplying both types of energy will require large capital expenditures, there are difficult decisions to be made.

Developing countries made clear their desire to have access to sophisticated modern technology that would allow the use of NRSE in industrialization efforts.

3.2 Formulation of a Plan of Action

The work of the Conference was divided into three parts - the development of a plan of action, a decision on an institutional arrangement for the implementation and monitoring of the program of action, and a decision on financing mechanisms. The last two issues were particularly contentious, and were unresolved at the close of the Conference.

A committee was set the task of developing a program of action including specific measures for each source of energy and including the definition of priority actions for any new institutional arrangement to come out of the Conference. The eventually agreed upon plan of action was a substantial improvement over the original preparatory committee draft. With regard to fuelwood, for example, the following specific recommendations were made.

Fuelwood and Charcoal

Bearing in mind that; (a) fuelwood including charcoal constitutes important sources of energy for large populations especially in the rural areas of developing countries; (b) that adequate management of forest resources to provide fuel, food and timber requires the assessment of projected supply and demand and the identification of deficit areas; (c) that their proper role must be seen in the context of the over-all energy requirements and the

particular problems of rural areas of most developing countries;
(d) and notwithstanding financial feasibility, especially in agroforestry systems, that broad-based support and participation of men and women in the development, management and efficient use of fuelwood are essential (taking into account the need for maintaining the ecological balance), the following specific actions have been identified:

(a) Assessment and planning

(i) Assess and evaluate forest resources in order to estimate their present and future sustainable yield of fuelwood, to identify deficit areas and areas in which reafforestation is both urgent and practicable;

(b) Research, development and demonstration

(i) Intensify and/or establish basic and applied research on more productive species;

(ii) Support and promote work aimed at improving the efficiency of stoves and cooking utensils, develop low-cost stoves and promote their widespread use, taking into account social and cultural acceptability;

(iii) Improve preprocessing of fuels, including those presently wasted such as twigs, branches and dry leaves, for use in direct combustion and other processes and improve the conversion efficiency of charcoal making;

(iv) Develop promising fuelwood and charcoal substitutes or supplements utilizing other new and renewable sources of energy.

(c) Transfer, adaptation and application of mature technologies

(i) Improve and/or establish forest management practices;

(ii) Increase and/or establish reforestation and afforestation programs with selected and tested species;

(iii) Promote and support programs, projects and

activities to establish large-scale plantations including afforestation in deficit areas and wood lots, establish distribution, control and pricing policies, and improve conversion and utilization technologies (charcoal production and gasification, kilns, ovens)."

Reference was also made to the use of forest energy under Biomass, where the recommendations included the following:

...accelerate the utilization of biomass resources for energy production through initiation and/or support for demonstration schemes such as biomethanation of manures, agricultural residues and other organic materials in different regions of the world; integration of biomethanation and ethanol production; small scale gasifier and stationary engines; electricity production using gasifiers and engine generators and including short rotation forestry in energy farms; gasification and indirect liquefaction to produce synthetic liquid fuels from lignocellulosic materials.

After identifying a program of action for each energy source, priority areas for action were set out. Among these priority actions were a number related to woodfuel. With respect to Research, Development and Demonstration of NRSE, priority was given to:

... identification of fast growing species for fuelwood production, reforestation and afforestation, especially in areas short of fuelwood,

... development of more efficient low cost stoves and charcoal production processes.

Under Transfer, Adaptation and Application of Mature Technologies (rural energy) the section on priority action states the following:

Of particular concern to developing countries is the need for taking urgent measures aimed at alleviating the accute domestic energy problem, particularly the fuelwood crisis, which is assuming alarming dimensions. One goal of the Nairobi Program of Action is that during the present decade, countries will undertake planned programs with a view to ensuring that the energy needs of the rural areas can be met on a sustainable basis. To that end, the following priority actions for transferring, adapting, and applying mature technologies in rural areas have been identified:

(i) Widespread application of improved practices and technologies for the conservation and more effective use of natural forestry resources;

(ii) Establishment and acceleration of programs for large scale reforestation and afforestation with selected and tested species, as well as for smaller scale wood lots and plantations of energy crops, particularly in arid, semi-arid and deficit regions, as part of an effort to increase five-fold the annual rate of fuelwood planting and to meet effectively and sustainably the demand for biomass fuels by the year 2000.

The Conference did succeed then in drawing up a Program of Action designed to encourage the development and the implementation of the use of NRSE. This program of action, especially in terms of the priority areas for action, gave considerable emphasis to problems in woodfuel supply and the need to take action in this area. It went so far as to specifically set a target of a five-fold increase in planting levels by the year 2000. The strong emphasis on fuelwood in the priority section was partially due to a strong lobbying effort led by Dr. Norman Myers (author of "The Sinking Ark").

However, the value of the plan of action is dependent on the development of the framework for carrying it out.

3.3 Institutional and Financial Arrangements

Committee One was delegated the responsibility of agreeing on institutional and financial mechanisms for carrying out the program of action. The key issues were the form of the institution and the body to which it would report, and financial targets and mechanisms for handling the funds.

The U.S. proposal was to give the responsibility for implementing and monitoring the program of action to the existing U.N. Committee on Natural Resources which reports to the U.N. General Assembly through the 52 member 'closed' U.N. Economic and Social Committee. The Group of 77 wanted to create a new body that would be an intergovernmental committee open to all U.N. member states reporting directly to the General Assembly and serviced by its own secretariat.

The other thorny question was financing. The Group of 77 proposal that the Nairobi Program of Action required "additional and adequate financial resources" was finally accepted, after initial opposition from the U.S. which felt that existing funds could be reallocated. However, there was disagreement over whether or not financial targets were to be set specifying the amounts of additional funds to be given.

Also, the Group of 77 stressed the need for multilateral mechanisms for disbursement of the funds, specifically the Energy Affiliate of the World Bank. The U.S. was opposed to new multilateral funding, especially the World Bank Energy Affiliate.

These disagreements were not resolved by the end of the Conference. The launching of the Nairobi Program of Action was entrusted to a Committee patterned on the Preparatory Committee for the U.N. Conference on NRSE. This Committee will hold one two-week session in 1982 and will report to the General Assembly through the Economic and Social Council. The final decision on institutional measures will be taken by the General Assembly at its thirty-seventh session.

No targets were set or arrangements made for additional financing other than voluntary committments on the part of countries attending the conference. An attempt will be made to generate more funding by holding consultative meetings at global regional and subregional levels among multilateral and bilateral donors and recipient countries. The Conference recommended that consideration be given to the creation of the World Bank's Energy Affiliate.

Therefore, the end result of the conference is a rather comprehensive if not specific plan of action with no implementing agency and no funds. Going back to the initial farsighted comments of the Prime Minister of Jamaica, the conference was allowed "to taper off into a device which rested on...doing only a part now of what this Conference had been called to do."

The World Bank Energy Affiliate, regarded by the Group of 77 as a key to implementing action on a large scale in the energy area was left hanging again, with "interested parties" being advised to "accelerate consideration of other possible avenues that would increase energy financing, including, inter alia those mechanisms being considered by the World Bank such as an Energy Affiliate."

3.4 Comments on the Forum Sessions at the Conference

There were a number of forums officially sponsored by the Conference in collaboration with U.N agencies on topics such as "energy and the environment", "energy and industry" and "energy and agriculture". These forums were held in the form of round tables with each speaker being given ten to twenty minutes followed by a general discussion. No formal papers were presented and the discussion, as could be guessed by the topics, was general in the extreme. Some of these forums touched on fuelwood related problems but only in terms of general platitudes.

There were also a series of round tables held by the Non-Governmental Organization Forum, one of which dealt specifically with fuelwood. It is worth discussing in some detail as the only "technical" session on woodfuel.

The panel discussion on fuelwood was made up of six people: Marilyn Hoskins, an anthropologist who has done considerable work on AID projects, Chandi Bhatt of the Chipko movement in India, John Spears, Forestry Adviser of the World Bank, David Kamwetti, a forester at the University of Nairobi, Keith Openshaw of the Beijer Institute, and Sun Yunchen of South Korea.

The discussion opened with a very lucid presentation by Keith Openshaw in which he first stated some of the problems surrounding wood energy including,

... wood, because it is a high bulk and low value product, must be in the right place at the right time. Planning for this is made difficult by the relatively long planning horizon in forestry projects,

... the planning process is dominated by men when gathering firewood is often the task of women and children,

... in many countries wood is seen as an old fashioned fuel; development planners feel they will be held back if they continue to use wood.

These are some of the reasons why the fuelwood problem is proving intractable in many countries despite the possibility of solutions.

According to Openshaw the possible solutions are: to switch to non-renewable sources of energy (now out), to switch to other non-commercial sources of energy, or to increase the planting of trees and

shrubs. The cheapest and best solution is to increase tree planting mainly on farms. That brings up the question - is there a tradeoff between food and fuel production? According to Openshaw this can be minimized by using tree species that actually enhance the productivity of the land. This is the agroforestry solution.

How long does it take to produce fuelwood in this way? According to Openshaw some species (Prosopis) can be grown from seed and be producing fuelwood in two years.

There is also a need for governments to plant trees to supply urban areas and industry. Such concentrated production would use far less land than would be required if supplies were to come from natural forest (1/5 as much).

One source of money for such projects would be a special tax on non-renewable energy sources.

Attempts must also be made to improve the image and efficiency of wood as a fuel, if it is to be acceptable to developing country planners.

The next speaker was Chandi Bhatt who described the development of the Chipko (hug the tree) movement in India. The Chipko movement grew out of the response of women in one mountainous area of India to the decision made by the government to sell the forest resources for commercial timber exploitation. The women who would have had to search much further afield for firewood, prevented the contractors who had been promised the forest resources from cutting them down. The villagers formed a movement to protect the trees and have actually begun a very successful reforestation project. Mr. Bhatt had several comments about the government's role as well as that of the World Bank in aiding reforestation - stating that the species that were selected were mainly good for commercial timber production and did not meet the needs of the people. He also stated that under no circumstances should monoculture forests replace the old multi species forests.

David Kamwetti spoke of fuelwood problems in Kenya. He pointed out that, even if oil were cheap, woodfuel would be a problem in Kenya. There is a large deficit in Kenya between annual sustainable production and annual cut of about 35 million tonnes.

Woodfuel shortages are appearing that have serious impact on people's survival. One of the problems with a lack of fuel supply is that it cuts into the diet. People begin to cook fewer meals or they select foods with lower cooking times that may also be less nutritious.

Marilyn Hoskins, an anthropologist specializing in development projects that need local co-operation, said that the first thing that's needed in any such project, especially firewood projects, is to ask the following questions;

1) What is the problem? Usually, for example, it is not just fuelwood, or there may be other problems with higher priority. For whom is it a problem - for the government, forestry service or the people on an individual or collective basis?
2) What are the options for solutions?
   Conservation
   Planting
   Changes in marketing, and marketing infrastructure research, need to be focussed more to these ends.
3) How can the solutions be implemented? For example, village woodlots will work only where there is a truly communal interest.
4) How are the benefits and losses distributed? Attempt to maximize benefits, minimize losses and distribute both as widely as possible.
5) If possible, offer options as to solutions - individual contracts or community arrangements may work well.

John Spears followed with a summary of the World Bank's position on fuelwood and charcoal. He reiterated the need for an additional 50 M ha of wood plantations in developing countries by 2000 and stated that the rate of planting needs to be increased overall by a factor of five by 1990.

He commented that the fuelwood and charcoal technical panel stated that an annual expenditure of $1 billion U.S. was needed but that this does not reflect the absorptive capacity of developing countries. There is a need to build up infrastructure and extension services before this scale of expenditure is possible.

A realistic target is a doubling or tripling of the current rate of planting. The Bank proposes to spend $1 billion in 5 years,

half of which has been obtained, the other half is still needed.

After the speakers, there were questions asked from the floor where several issues were raised. Dr. Norman Myers pointed out that the possibility of transporting wood from surplus areas to deficit areas has not been thoroughly investigated. This would reduce planting needs substantially. However, unless good management practices were instituted, it would probably result in more forest devastation and is not a long term solution.

Another member of the audience stated that the panel had put virtually all of the emphasis on forestry solutions and very little on improvements in utilization; improved stoves and improved charcoal production methods.

Another person commented on what he perceived as the highly technocratic nature of the discussion and emphasized that the starting point for any solution to the woodfuel problem is to find out from the people what the problem is and what they want done about it.

The Panel concluded with the drawing up of a resolution to be signed by a number of the NGO's, reiterating the importance of action to increase fuelwood supply, and the need for the Conference to put more emphasis on this problem.

A similar fuelwood resolution was eventually put forward at the Conference by Angola, China, Colombia, India, Kenya, Nepal, Phillipines, Rwanda, Sweden, Tunisia and Zimbabwe (Doc. A/Conf. 100/L.9 Rev. 1). The text of this resolution follows:

New and Renewable Sources of Energy in the Context of Development

Angola, China, Colombia, India, Kenya, Nepal, Philippines, Rwanda, Sweden Tunisia and Zimbabwe: revised draft resolution

New and renewable sources of energy in the context of rural development

The United Nations Conference on New and Renewable Sources of Energy

Recognizing the importance of urgent action to meet the energy requirements of rural communities in vast areas of the world,

Noting that growing population and increasing pressure on land on account of development activities have led to denudation of forests with consequent crisis of fuelwood and ecological damage in several developing countries,

Noting further that various renewable energy technologies have been developed and are being developed which could in particular national circumstances increasingly meet the household, agricultural and industrial energy requirements of rural communities.

1. Urges immediate acceleration of programs of reforestation and afforestation consistent with national energy policies with a view to significantly enhancing the production and availability of fuelwood, and in seriously affected areas, as part of the effort to achieve a five-fold increase in annual tree planting rates by the year 2000;

2. Urges also the acceleration of programs for the development and widespread utilization of other new and renewable energy sources such as biogas, wind, solar, hydro, geothermal and peat where economically viable, with a view to reducing the pressure on fuelwood supplies and also to improve the standards of living in rural areas;

3. Calls upon all countries, the United Nations system, and international financial institutions effectively to encourage, support and promote programs mentioned in paragraphs 1 and 2 above in the developing countries.

4. A SUMMARY OF CONFERENCE DOCUMENTATION WITH RESPECT TO WOOD ENERGY

4.1 Summary of the Report of the Technical Panel on Fuelwood and Charcoal in its Second Session

This paper is widely regarded as among the best produced for the Conference. Among the often quoted information presented in the report is the following. Nearly half of the world's population (2 billion people) depend on fuelwood, charcoal, animal dung and agricultural waste for cooking.

More than one hundred million people cannot obtain enough fuelwood for their cooking needs while an additional billion people are affected by shortages. If present trends continue, over 2.5 billion people will need to be provided with alternative fuels by the year 2000.

There is no alternative energy that could provide a viable substitute for fuelwood within the next quarter century. That means that the growing demand for fuelwood will threaten environmental stability and agricultural potential as over-exploitation of the world's forests causes erosion and desertification.

The report stresses that no new technology is needed to solve this problem. What is needed is political will. The Panel recommended that the Conference, as its most important objective, make known the *dimension and nature* of the energy needs that must be met by fuelwood and charcoal and that governments and the international community determine to implement the actions required in order to meet those needs.

Fuelwood and charcoal now supply about one-fifth of the energy consumed in developing countries, 5.4% worldwide. About 59% of all wood removals worldwide is used for fuelwood and charcoal. In some countries in Africa, fuelwood and charcoal amount to over 90% of all energy requirements.

Average per capita consumption for cooking is approximately 0.5 m^3/y, equivalent to one-tenth of a tonne of oil or 150 continuous watts. Countries such as Brazil, Bolivia and Argentina also use large quantities of wood as fuel in industry.

The Panel recommends five major areas of action which include:

... increasing the productivity of existing forest resources,

... creating new fuelwood resources through large scale plantations, community or village woodlots and farm or individual planting. Current rates of planting must be increased five-fold,

... organizing the distribution of firewood,

... improving conversion processes through pre-processing fuels, improving charcoal production methods, and improving the efficiency of end use of wood through cook-stoves,

... substitution of other energy sources for fuelwood and charcoal (limited by a lack of feasible alternatives).

Under each of the major headings listed above are a number of specific recommendations. The report also recommends that the use of charcoal should be discouraged where possible since 60% of the energy available is lost in the conversion process.

The report calls for immediate action "without awaiting further studies...only massive programs of action are likely to have a sizeable impact...there is little risk of overestimating the action needed."

4.2 Summary of References to Wood Energy in the National Reports

Argentina (Spanish, 29 p.)

Fuelwood use is estimated at 1 Mt/y while firewood used to produce charcoal is estimated at an additional 2 Mt/y. Total use of fuelwood is predicted to rise to 14 Mt/y by the year 2010.

Benin (French, 12 p.)

Annual use of fuel is estimated at 3.4 Mm^3/y. There is a considerable shortage of fuel around villages, calling for immediate action such as reforestation, more efficient use of wood, research into short rotation forestry and into modern methods of using woodfuel (pyrolysis, gasification).

Brazil (English, 32 p.)

Brazil contains vast areas of forest cover which yield a much more rapid and lavish growth than in temperate regions. The supply of wood in Brazil in 1980 was estimated at 1.4 billion t in 1980, while the quantity of fuel oil used in Brazil in 1980 was 18.6 Mt, equivalent to 59.5 Mt of wood. Brazil is, therefore, encouraging the substitution of charcoal for fuel oil wherever possible. The Brazilian energy plan calls for charcoal to supply 120,000 boe/d of charcoal by 1985, (24% of total estimated use of fuel oil), accounting for just under 8% of total energy use in that year. A substantial amount of charcoal is used in metal reduction.

Pilot scale projects are also underway to investigate the production of methanol from wood to complement the alcohol from cane program.

In 1980, Brazil had roughly 3 Mha of reforested land.

Canada (English, 38 p.)

Biomass now contributes about 3.5% to total primary energy use in Canada, mainly through the use of waste by the pulp and paper industry. This contribution is expected to increase to 6% by 1990. Key areas in which Canada has developed expertise include forest management; rapid silvicultural/biomass production techniques; woodburning stoves for heating and cooking; combustion boilers; gasification; alcohol fuels. Brief descriptions are given of activities in each of these areas.

China (English, 17 p.)

Biomass contributes more than one-quarter of the total energy consumption of the country equivalent to 220 Mt of standard coal, mainly in the form of fuelwood and straw. China has in recent years been cultivating forests for fuelwood and carrying out programs for the modification and distribution of stoves to reduce firewood consumption and environmental pollution. Also, an extensive program to introduce biogas has resulted in the construction of 7 million digesters to reduce pressure on forests.

Denmark (English, 21 p.)

No quantitative estimates are given. The document says that the contribution to energy supply of residual wood and firewood is limited and serves only as a heating supplement.

Dominican Republic (Spanish, 31 p.)

Wood and charcoal amount to 13% of total energy use in the Dominican Republic, mainly being used as domestic fuel. A project has been carried out to evaluate the potential of tree plantations as a source of energy. It was carried out by the Mitre Corporation and financed by A.I.D. The second stage, involving a nursery to produce 500,000 plants, has not yet been financed.

The study indicated the availability of 520,000 ha of arid and semi-arid land that could be used for tree plantations. It indicated that electricity could be generated in plants of 1 to 50 MW for 40% of the costs of petroleum generated electricity.

Finland (English, 29 p.)

It was estimated that 4.1 Mt of wood energy were used in Finland in 1979; 1.5 was in the form of fuelwood for space heating, 0.5 was industrial waste wood and bark, and 2.1 was industrial waste wood slurreys. This total amounted to 16% of total energy consumption, one of the highest ratios in the industrialized world.

Finland has estimated fuelwood resources in the forest and in the form of industrial waste wood of 15 Mm^3/y with an energy content of about 3 Mtoe/y. Finland estimates that the amount of energy derived from wood could be doubled.

Finland's future forest energy production potential, including fuelwood short rotation plantations, is estimated to be 6-7 Mtoe in 1990 and about 10 Mtoe/y by the end of the century. However, in order to make full use of this quantity of wood, processed, easily

transportable and usable fuel products of consistent quality must be developed.

France (French, 32 p.)

France, as part of its long term energy policy, plans to increase the use of fuelwood from an estimated 3 Mtoe in 1980 to 5.5 Mtoe in 1990 and 10 Mtoe in 2000. These additional supplies will come from the use of wastes of the forest product industry and from fuelwood plantations and reforested areas.

Forest energy will be used as a fuel in the forest industries and as a rural heating fuel.

Guinea (French, 25 p.)

Guinea has important forest resources, the forested area is 13,000 km^2 while artificially forested areas amount to 40 km^2. Annual consumption is estimated at 1.1 Mt. This level of consumption brings with it serious deforestation problems. Between 1960 and 1977, the forested area was reduced by 34%.

A project to promote the use of efficient stoves is being carried out in Guinea. This project is being financed by a number of agencies including UNICEF and FAO.

Guyana (English, 9 p.)

78-84% of the 216,000 km^2 area of Guyana is covered with forest. Total timber extraction (mainly commercial timber extraction of a few species) only utilizes 15-20% of estimated total exploitable timber resources. There is a tremendous untapped biomass potential. The paper goes on to discuss in general terms the potential use of logging waste for the production of charcoal or wood chips. Sawmill waste from the 110 sawmills in Guyana (total capacity 300,400 m^3, operating at 35% capacity in recent years) could also be used to supply the energy needs of the sawmills and nearby residential areas.

Two pilot projects are being carried out in the area of sawmill wastes. The Upper Demerara Project funded by the IADB and the EEC with a capacity of 42,000 m^3 of timber per year will be powered by 5 x 0.94 MW wood gas fired generators which will supply about 5 MW of power for sawmilling and residential requirements. Guyana Timbers Ltd. is studying ways to utilize sawmill waste to produce steam for wood drying kilns as well as for driving steam turbines for on site electricity generation.

There is a potential for energy farming based on plantation-type growing of fast regenerating species such as Acacia aulococarpa which can be harvested in 5-10 years.

India (English, 32 p.)

Firewood is the most important non-commercial fuel in India; its consumption in 1975-76 was estimated at 133 Mt. About 23% of the total area of India is forest covered. Fuelwood supplies are becoming increasingly difficult to obtain as the result of increasing population and competing pressures on land. The concept of energy plantations is receiving attention. A number of tree species, shrubs and other plants suitable for energy plantations have been identified. A fuelwood plantation scheme has been launched in Rajhastan with technical support from the Central Arid Zone Research Institute, Jodhpur.

Studies have been conducted on the use of marginal soils for energy plants. Tree species which can be grown on saline and alkaline soils have been identified.

Considerable research has been carried out in India on the different bioconversion routes for ethanol production from cellulosic residues.

Indonesia (English, 33 p.)

Total consumption of fuelwood was estimated at about 39 Mt in 1980. Its use is estimated to be growing at 3 to 4 percent per year despite a program to encourage the use of kerosene through subsidization of kerosene prices.

Investigations into firewood plantations were begun in 1975 resulting in promising yields of 70-120 m^3/ha/y for Caliandra production on suitable soils.

Two extensive programs are underway to create new fuelwood resources; the reforestation program to establish new forests on government or public land and the greening program which is the encouragement of planting perennial species on private and community property. The annual target is designed to establish 300,000 ha of new forest and to "green" 70,000 ha of critical private land.

Free distribution of 15 to 20 firewood species which are fast growing perennials with profitable by-products has been started. The greening program is essentially aimed at increasing the vegetative cover of critical land areas to combat erosion and flooding. Efforts

have been made to use 10 to 12% of the greening program budget for firewood production. Up to 1980, 65,810 ha of land have been planted with fast growing trees. The next step is to create 100,000 ha of firewood plantations each year which should yield more than 10 t/ha/y after 2 years.

The use of logging and sawmill waste is being encouraged.

Ireland (English, 35 p.)

Ireland is heavily dependent on imported oil and anxious to find alternative sources of energy. Biomass is considered to have good potential in the medium term (especially forest biomass). The low population density of Ireland means that there are large areas of land available for the establishment of forests. Research has been conducted since 1976, originally concentrating on species trials, harvesting systems, and burning properties of different woods. The work, largely being carried out by AFT (the Irish Agricultural Institute) and the Forest and Wildlife service, is now in the demonstration phase with 400 ha of short rotation forestry and 200 ha of single stem forestry being established. A harvester for the former is being designed and built, and existing electricity generating boilers are being adapted to burn the resulting biomass. The project will be completed in 1985 and is expected to show the viability of electricity generation from biomass. Yields from conifers average 14 m^3/ha/y while yields from short routine species such as Populus, Alnus and Salix are expected to be even higher. It has been calculated that by the year 2000, 400,000 ha of SRF coppice could yield at least 2 Mtoe for Ireland per year.

The Irish National Board for Science and Technology is the operating agent for the IEA's Biomass Conversion Technical Information Service which provides a source of scientific and technical data on all aspects of biomass.

Kenya (English, 24 p.)

Estimates of the annual consumption of woodfuel are in the order of 30 Mm^3 (22 Mt of air dry wood) or approximately 7 Mtoe resulting in an annual saving of foreign exchange of ŁK200 million (U.S. $485 million) per year. Projected demand for fuelwood by the year 2000 would range from 30-55 Mm^3/y depending on the adoption of more efficient cooking stoves and charcoal production methods.

The tree resource is already being depleted and there is insufficient growing stock. The importance of this problem is recognized and farmers are being encouraged to plant trees on their farms and establish village woodlots and fuelwood plantations. A Presidential decree has been passed to the effect that every administrative location in Kenya should have at least one seedling nursery to supply seedlings to the local population. It has also been decreed that for every tree cut down there must be a replacement. An area equivalent to about 2 Mha may need to be planted with trees between now and the turn of the century if Kenya's woodfuel requirements are to be met (assuming annual production of 15 m^3/ha/y).

Nigeria (English, 34 p.)

Fuelwood is the most widely used fuel in Nigeria accounting for 40% of total energy consumed. An estimate of annual consumption of 70 Mm^3 (about 38 x 10^9 kg of wet wood) is thought to be a minimum. Its use is not only rural but extends to urban centers such as Lagos, Ibadan, Kano, Kaduna, etc.

Fuelwood plantations are now supplementing wood available from the free forests but pressure on land has tended to reduce these plantations.

The main problem associated with woodfuel use is the inefficiency of wood burning equipment. Improvements in all woodburning stoves should be implemented and commercialized.

Figures for Ibadan indicate that woodfuel energy costs 10.6 k/MJ while the corresponding figures for charcoal, bottled gas and kerosene are 29.73 k, 30.0 k, 49.0 k per MJ respectively.

Recommendations for action include,

... charcoal kilns should be designed to improve recovery factors and commercialized,

... afforestation including plantations of special tree species and shrubs (e.g. Euphorbia) should be undertaken,

... work should be undertaken on the production of liquid fuels from forest biomass.

Norway (English, 45 p.)

Norway's annual yield of timber (trunks with bark) is estimated at about 18 Mm^3; of which about 12 Mm^3 is used in timber

production. If branches, tops and roots were included, the total yield could be estimated at 25-30 Mm^3 annually, theoretically equivalent to 4.7 Mtoe.

Most timber is used for industrial purposes resulting in about 350,000 tons of bark and a corresponding amount of waste chips annually which are largely used within the industry.

However, there is the potential to use tree stumps, felling wastes, thinnings, etc. This biomass could be burned directly or transformed into liquid fuel or gas. For the time being, the solid forms such as fuelwood, chips and charcoal seem to be of most immediate interest. In the short term, the greatest possibilities lie in utilizing chips or briquettes in larger district heating plants or in smaller units.

Today, biomass represents 1% of all energy production. Studies show that it is possible to extract economically marginal forestry products corresponding to an energy amount of 25 PJ/year, close to 3% of today's total energy production.

Rwanda (French, 30 p.)

Fuelwood is widely used in rural areas for cooking and space heating. Eucalyptus is the dominant tree species on publicly owned forest land which accounts for 13% of the total forested area. The majority of fuelwood comes from privately and community owned land. Fuelwood consumption is estimated at 6.9 Mm^3/y, charcoal consumption at the equivalent of .3 Mm^3 of fuelwood for a total of 7.2 Mm^3/y.

Seychelles (English, 6 p.)

One of the projects that will be carried out in the Seychelles relates to biomass gasification for power production. Pilot facilities of the moving bed gasifier type or of the fluidized bed type gasifier will be investigated, and a unit will be purchased for test runs using coconut husks. Tests will be carried out to establish the feasibility of growing hybrids such as Leucaena or Casuarina as an intercrop with coconut to increase the potential biomass yield.

Sierra Leone (English, 6 p.)

Fuelwood and charcoal are the main sources of energy for cooking throughout the country. Total consumption has been estimated at 2.5 Mm^3/y of which 250,000 is supplied to Freetown. Sawdust and woodwaste are being utilized by the Forest Industries Corporation at

Kenema. Forestry projects sponsored by multilateral and bilateral aid will concentrate on reforestation, production, manufacture and distribution of fuel efficient stoves, training of forestry and wood industry personnel, and reorganizing forestry policy and organization. Efforts will be made in the Integrated Agricultural Development Projects to establish village woodlots using quick growing trees.

Spain (Spanish, 37 p.)

Estimates of waste in the forest industry amount to 15.9 M t/y of which 25% is recoverable. Despite the high costs of recovering and transporting forest wastes to the conversion site, Spain plans to make greater use of this energy source.

Sudan (English, 34 p.)

Firewood contributed 69% of all energy consumed in the country in 1979/80, while charcoal contributed 6% for a total of 75%. The total amount of firewood consumed is estimated to be 10.65 Mt. nearly 98% of this was consumed as a household fuel and in domestic services and bakeries, mainly in rural areas. The other 2% was used in rural industries.

Almost all fuelwood was obtained from natural forests and desert scrub, with plantations contributing about 1.3%.

Fuelwood is obtained for household consumption free or at low costs, but royalties are collected against the amounts used in bakeries and rural industries. A considerable amount of firewood is transported by road or rail from distances as great as 500 km at high cost.

The main household and domestic fuel in urban areas is charcoal, amounting to 550,000 t in 1979/80. Charcoal again is transported by road and river at very high cost.

The total amount of woodfuel (for both firewood and charcoal) removed from the forest annually exceeds 13 Mt with an annual rate of increase of 2.2%. This has resulted in desert creep, soil degradation and increased aridity in northern, central and western Sudan. The afforestation program is meager and inadequate. Present rate of afforestation is 7,000 ha/y compared to the 120,000 ha/y that are considered to be necessary. The main reason is inadequate financial resources.

There is scope for more efficient use of the equipment for burning both wood and charcoal, and for the improvement of the

efficiency of wood/charcoal conversion in kilns. A forecast of fuelwood consumption in the year 2000 is 22.7 Mt, according to a renewable energy task force study.

Sweden (English, 38 p.)

In 1979, wood waste supplied approximately 6.5% of the energy needs of Sweden. It is estimated that by 1990 forest energy could supply 2-3 Mtoe. There is a large potential for energy forest plantations since the availability of suitable land on a per capita basis is large and since some 50% of Sweden is already covered by forests (23.5 Mha). Sweden's timber stock is estimated at 3.8 billion m^3 (or 660 Mtoe). The annual total growth is estimated at 120 Mm^3. By-products used as fuel in the forest industry to process the annual harvest of 73 Mm^3 of timber and pulpwood amount to 2.6 Mtoe. Logging residues that are now wasted amount to 45 Mm^3 or 7.8 Mtoe. The total economically recoverable portion of these wastes is estimated at 17 Mm^3 with present felling methods, and 26 Mm^3 with future methods ("whole tree", "part tree"). Efforts are being made to improve felling techniques.

Forest residues are being used and will be used primarily in hot water centers, district heating plants, industrial boilers and on farms. Production costs with present techniques are in the range of $11-23/boe.

Investigations are proceeding in the area of energy forestry. Small scale experimentation indicates production of 20 t dry substance (60 m^3) /y/ha, which is considerably in excess of previously observed production volumes in cold climate areas. Large scale experimental cultivations have begun on abandoned agricultural soil and marshlands. The goal is to enable the production potential and costs of energy forests to be reliably appraised by the mid 1980's.

Thailand (English, 17 p.)

The demand for fuelwood in 1979 was 30 to 40 Mm^3. Recent satellite imagery resulted in estimates of forest cover of 25% and it is estimated that if current trends continue, the supply from natural forests will decrease to 14 Mm^3 by 1985.

There is a fuelwood and charcoal development plan with the goal of reforestation of an area of 720,000 ha with fast growing trees. By 1989, production from these areas is expected to be 12.9 Mm^3/y

which together with production of 9.5 Mm^3/y from the natural forest will be sufficient to supply the demand. Total investment cost is estimated at $310 million.

Tunisia (French, 13 p.)

Like all arid and semi-arid areas, the productivity of forest biomass in Tunisia is low. Exploitation is estimated at 2 Mt/y. The government has elaborated a plan for the conservation of existing forests and reforestation.

U.S.A. (English, 110 p.)

This report discusses briefly the fuel costs of different woodfuels for different purposes, with energy costs for the residential sector about $2-5 per GJ, wood chips and pellets estimated to cost $35-53 per dry tonne ($2.00-3.00 per GJ) depending on transportation cost. A brief description is given of activities by government and the private sector with respect to wood and biomass energy, and of the state of development of wood energy in the U.S. with respect to cost competetiveness with fossil fuel, degree of social acceptability, environmental acceptability and availability of financing and data.

Zambia (English, 8 p.)

Wood consumption in 1978 was estimated at 12.8 Mm^3 of which 7.8 Mm^3 was used in rural areas (2.4 Mm^3 as firewood, the remainder as charcoal) and 50 Mm^3 was used in urban areas (0.5 Mm^3 as firewood, the remainder as charcoal).

Research is being conducted into improving the design of charcoal stoves. Research is also being carried out on the more efficient production of charcoal.

4.3 A List of Conference Documentation

4.3.1 Fuelwood Related Official Documents

1. Report of the Technical Panel on Fuelwood and Charcoal in its Second Session.
2. Report of the Technical Panel on Biomass in its Second Session.
3. National Reports from
   1. Argentina (Spanish)
   2. Benin (French)
   3. Bolivia (Spanish)
   4. Brazil (English)
   5. China (English)
   6. Colombia (Spanish)
   7. Dominican Republic (Spanish)
   8. France (French)
   9. Guinea (French)
   10. Guyana (English)
   11. India (English)
   12. Indonesia (English)
   13. Ireland (English)
   14. Kenya (English)
   15. Nigeria (English)
   16. Norway (English)
   17. Peru (Spanish)
   18. Rwanda (French)
   19. Seychelles (English)
   20. Sierra Leone (English)
   21. Spain (Spanish)
   22. Sudan (English)
   23. Surinam (English)
   24. Sweden (English)
   25. Thailand (English)
   26. Tunisia (French)
   27. U.S.A. (English)
   28. Zambia (English)
4. Unofficial Documents
   1. Bina Agarwal, "The Woodfuel Problem and the Diffusion of Rural Innovations", Science Policy Research Unit, University of Sussex, 1980, 186 pages.
   2. Beijer Institute, Producer Gas 1980, Local electricity generation from wood and agricultural residues, 87 pages plus 5 appendices.
   3. Chandi Prasad Bhatt, "Trees, a Source of Energy for Village Dwellers", Chipko Movement, 6 pages.
   4. Companhia Energetica de Sao Paulo, "Methanol from Wood in Brazil", 11 pages.
   5. Energy, Mines and Resources Canada, Biomass Energy in Canada: Its Potential Contribution to Future Energy Supply, March 1980, 178 pages.

6. Energy, Mines and Resources Canada, Opportunities for the Use of Biomass Energy in the Industrial, Commercial and Institutional Sector, 1980.

7. Energy Research and Development Commission, Renewable Sources in Sweden, Stockholm, 1981, 105 pages.

8. F.A.O., Map of the Fuelwood Situation in Developing Countries, 1981, 11 pages plus map.

9. Marilyn Hoskins, "Community Forestry Depends on Women", from Unasylva, Vol. 32, No. 130, 6 pages.

10. I.C.R.A.F., Agroforestry Series: A Cropsheet Manual, 1980, 226 pages.

11. I.C.R.A.F., International Co-operation in Agroforestry, Proceedings of an International Conference, July, 1979, 470 pages.

12. _____, Soils Research in Agroforestry: Proceedings of an Expert Consultation, March, 1979, 584 pages.

13. David Kamwetti, "An Overview: Fuelwood and Charcoal/Tree Planting for Energy", University of Nairobi, 1981, 16 pages.

14. National Academy of Sciences (U.S.), Firewood Crops; Shrub and Tree Species for Energy Production, Washington, 1980, 237 pages.

15. _____, Proceedings of an International Workshop on Energy Survey Methodologies for Developing Countries, January 1980, 220 pages.

16. Keith Openshaw, "Investment in Forest Industries: Looking Gift Horses in the Mouth", University of Dar es Salaam, Forestry Division, 39 pages.

17. _____, "Woodfuel and the Energy Crisis: Problems and Possible Solutions", Beijer Institute, 1981, 12 pages.

18. Nigel Smith, "Wood, an Ancient Fuel with a New Future", Worldwatch Institute, January, 1951, 48 pages.

19. John S. Spears, "Overcoming Constraints to Increased Investment in Forestry", World Bank, 1980, 52 pages.

20. Svedlund, Gasgenerator A.B., 3 pages.

21. Dr. Per E. Thorsen, "Charcoal - A Possible Energy Carrier for Wood", Norwegian Research Establishment, Norway, 19 pages.

22. UNEP, New and Renewable Sources of Energy: the Environmental Dimension, Nairobi, 1981, 35 pages.

23. ____, Energy and Environment in East Africa: Proceedings of an International Workshop, 1980, 404 pages.

24. World Bank, Energy in the Developing Countries, August, 1980, 92 pages.

25. World Bank/FAO, "Forestry Research Needs in Developing Countries", August, 1981, 56 pages.

4.3.2 General Documentation

1. Draft Report of the U.N. Conference on New and Renewable Resources.
2. List of Conference Participants.
3. Other National Papers (papers do not include references to woodfuels).

1. Algeria (French)
2. Australia (English)
3. Cape Vert (French)
4. Congo (French)
5. Democratic Yemen (English)
6. Fed. Republic of Germany (English)
7. Germany Democratic Republic (English)
8. Israel (English)
9. Italy (English)
10. Iraq (English)
11. Somalia (English)
12. Jordan (English)
13. Korea (English)
14. Lebanon (English)
15. Liberia (English)
16. Netherlands (English)
17. Pakistan (English)
18. Romania (English)
19. Senegal (French)
20. Venezuela (Spanish)
21. U.K. (English)
22. U.S.S.R. (English)
23. Zaire (French)

4. Preparatory Reports for the Conference

1. Technical Panel Reports on

1. Geothermal Energy
2. Wind Energy
3. Ocean Energy
4. Oil Shales and Tar Sands
5. Solar Energy
6. Hydropower
7. Peat
8. Drought Animals

2. Synthesis Reports
   1. Report of the Synthesis Group
   2. Synthesis of Technical Information on New and Renewable Sources of Energy
   3. Synthesis of Technical Panel Reports
3. Expert Group Reports
   1. Financing
   2. Education and Training
   3. Research and Development and Transfer of Technology
   4. Information Flows
   5. Industrial Issues
4. Report of the Relevant Organs, Organizations and Bodies of the United Nations System on Activities in the Field of New and Renewable Sources of Energy.

4.4 Abstracts of Major Documents Available at the UN Conference on New and Renewable Energy Sources in Relation to Fuelwood and Charcoal

Chandi Prasad Bhatt, "Trees, a Source of Energy for Village Dwellers", 6 pages. Some ideas by the author on afforestation and reforestation based on the experiences of the Chipko (hug the tree) movement in India.

Marilyn Hoskins, "Community Forestry Depends on Women", from Unasylva, Vol. 32, No. 130, 6 pages. This brief paper discusses the need for the involvement of women in afforestation and reforestation programs and in the designing and distribution of wood stoves.

Energy Research and Development Commission, Renewable Energy Sources in Sweden, Stockholm, 1981 (105 pages). Contains two chapters on forest energy and energy forestry that include detail on the current use of forest energy as fuel, wood prices and fuel values, silvicultural and environmental aspects of forestry. The second chapter on energy forestry includes descriptions of alternate systems of cultivation, production and harvesting with brief examples of total yield and cost.

ICRAF, Agroforestry Species: A Crop Sheet Manual, P.K.R. Wain, 336 pages. This study brings together a set of "crop" sheets describing some plant materials which can be used in agroforestry. It is a selected list of "crops" and has not treated the subject of tree species although some tree crops are included. A future publication will deal with tree species.

22. UNEP, New and [illegible] Agroforestry, Proceedings of an Dimension [illegible]979 (490 pages). Deals with

23. ____ [illegible]ry in arid areas, savannah areas, ar [illegible]d tropics. Describes some

24. [illegible] Sources [illegible]e world. Discusses some aspects of [illegible]-economics of agroforestry.

[illegible]try: Proceedings of an Expert [illegible]26-30, 1979 (584 pages). This working [illegible]on of papers from specialists on [illegible]gical aspects of soil, from the [illegible]re and forestry. Includes papers on soil [illegible] physical conditions, methodologies for monitoring soil proper[illegible], and comments on research methods and strategy.

David Kamwetti, "An Overview: Fuelwood and Charcoal/Tree Planting for Energy in Kenya", University of Nairobi, 1981 (16 pages). Paper highlights the Kenyan fuelwood situation and problems in realizing large enough supplies for the needs of the people. Describes patterns of consumption and supply as well as experience with strategies to overcome the woodfuel deficit.

National Academy of Sciences (U.S.), Firewood Crops, Shrub and Tree Species for Energy Production, Washington, 1980 (237 pages). Gives a brief description of some 70 odd species suitable for growing firewood for individual family needs. Most of the plants are little known in traditional forest production. Some are woody shrubs rather than trees. Information is given on native habitat, burning properties, yields, other uses, environmental requirements, establishment needs, pests and disease, limitations, and related species.

National Academy of Sciences (U.S.), Proceedings of an International Workshop on Energy Survey Methodologies for Developing Countries, January 1980 (220 pages). This publication includes the highlights of a workshop on energy survey methodologies in developing countries, including surveys of wood fuel and charcoal use. Also includes a directory of energy surveys in developing countries. It lists and identifies energy surveys, indicates which countries and

which donor organizations have carried out surveys, and describes briefly the goals and designs of such surveys.

Keith Openshaw, "Investment in Forest Industries: Looking Gift Horses in the Mouth", University of Dar Es Salaam, Forestry Division (34 pages). Seven forest industries have been examined to see what are the employment potentials, profits, foreign investment, requirements, saving of foreign exchange, break even point, capital investment and the return on the investment. Fuelwood, poles, and charcoal production, the so-called non-industrial products give the best returns. It is concluded that investment strategies should be reconsidered and much more attention be given to investment in fuelwood and pole plantations and their related industries.

Nigel Smith, "Wood: An Ancient Fuel with a New Future", Worldwatch Institute, January, 1981 (48 pages). Discusses the wood resource base and its potential worldwide, in devleoped and developing countries, with regard to residential use, industrial use, wood as a liquid fuel and the environmental impact of its use.

John Spears, "Overcoming Constraints to Increased Investment in Forestry", World Bank, July 1980 (52 pages). In implementing its forestry lending program the Bank has had to deal with a series of institutional issues which, in the past, were widely regarded as constraints to investment in forestry. This paper describes how these issues were dealt with in World Bank projects.

Dr. Per E. Thoreson, "Charcoal - a Possible Energy Carrier for Wood". Norwegian Research Establishment, Norway (19 pages). Brief description of research carried out on developing efficient charcoal production methods and efficient charcoal and wood burning stoves. Describes an industrial project where the initial energy unit is a pyrolysis reactor to produce charcoal.

UNEP, Energy and Environment in East Africa: Proceedings of an International Workshop, Nairobi, March, 1980 (404 pages). Provides a "case study" of the energy problems of a subregion of the Third World. Includes papers on common firewood and charcoal plants of Kenya, patterns of urban energy use in Nairobi, a comparison of metal and clay charcoal cooking stoves, and the present and the future patterns of consumption and production of wood energy in Kenya.

World Bank/F.A.O., "Forestry Research Needs in Developing Countries, Time for a Re-Appraisal", August 1980 (56 pages). Changing emphases in developing country forestry programs are detected and new priorities for research are identified. These are directed towards the contribution of trees and forests to increased agricultural productivity and rural development, to the increased production and more efficient use of wood-based energy, and to the conservation and management of existing forest resources. Strategies advocated for ensuring more intensive research in these areas and for meeting technical and physical research needs include strengthening national research institutions in the developing countries themselves and more effective 'twinning' of national agencies with some 90 existing research agencies identified in the paper which are already carrying out research in these priority areas.

5. AN OBSERVER'S APPRAISAL OF THE CONFERENCE

5.1 Introduction

One of the few aspects of the Conference to arouse media interest was the Fuelwood March held to dramatize the "other" energy crisis that is being experienced by many of the two billion people dependent on non-commercial energy sources. Foresters have long recognized the growing urgency of the fuelwood supply situation in many regions of the world. However, development planners are just beginning to tackle this problem.

The Conference preparatory background report by the Technical Panel on Fuelwood and Charcoal clearly documents the growing seriousness of the situation. Nearly half of the world's population is dependent on fuelwood, charcoal, animal dung and agricultural wastes for cooking fuel.

More than one hundred million people are now in a position where they cannot obtain enough fuelwood for their cooking needs, while an additional billion people are affected by shortages. If present trends continue, over 2.5 billion people will need to be provided with alternative fuels by the year 2000.

There is no alternative source of energy that could provide a viable substitute for fuelwood in the next quarter century. That means

the growing demand for fuelwood will threaten environmental stability and agricultural potential, as over-exploitation of the world's forests causes erosion and desertificaiton.

The panel report stresses that no new technology is needed to solve this problem. What is needed is political will. The panel recommended that the Conference, as its most important objective, make known the dimension and nature of the energy needs that must be met by fuelwood and charcoal and that governments and the international community determine to implement the actions required in order to meet those needs.

The panel recommended that action be taken in five major areas including,

... increasing the productivity of existing forest resources,

... creating new fuelwood resources through large scale plantations, community or village woodlots, and farm or individual plantings,

... organizing the distribution of firewood,

... improving conversion processes for preprocessing fuels, improving charcoal production methods and improving the efficiency of end use through woodstoves,

... substitution of other energy sources for fuelwood where practicable.

The report calls for immediate action:
"without awaiting further studies...only massive programs of action are likely to have sizeable impact...there is little risk of overestimating the action needed".

It estimates that the recommended five-fold increases in levels of tree planting would cost an average of $1 billion U.S. per year to the year 2000.

5.2 Objectives of the Conference

The UN Conference on New and Renewable Energy Sources had as its objective "elaborating measures for concerted action designed to promote the development and utilization of new and renewable sources of energy, with a view to meeting future overall energy requirements, especially those of the developing countries". Fourteen energy sources were under consideration - solar, biomass, wind, hydro, fuelwood and charcoal, geothermal, ocean, oil shale and tar sands, peat, and the use

World Bank Stability Forests

ergy purposes. However, among these
d charcoal are now in widest use and it was
nce would devote considerable attention to the

been expected to give impetus to programs
lwood supplies in the following ways,
ng a forum for the exchange of experience and
on about woodfuel and charcoal projects,
... by [illegible]ng an awareness of the magnitude and consequences of the problem among energy planners, politicians and the public,
... by developing a plan of action with clear-cut priorities with respect to fuelwood and charcoal,
... by developing an institutional framework and adequate funding to carry out the plan of action.

The Conference in many ways was yet another test of the ability of the UN to mobilize international co-operation. The success of the Conference with respect to these various objectives for fuelwood and charcoal, and new and renewable energy sources in general, will be discussed below.

5.3 The Exchange of Experience and Information

The Conference provided a forum for dissemination of knowledge and experience in a number of ways: through the preparatory documents, through meetings at the Conference itself, and through the exhibition that was mounted by a number of countries.

In general, and with respect to fuelwood and charcoal, the preparatory documents were a mixed lot. The Technical Panel Report on Fuelwood and Charcoal was an excellent summary of the situation. However, the papers of UN organizations and the national papers dealt mainly in generalities. Little concrete information was given about activities with respect to the different energy sources. Notable exceptions were the papers of Canada, Sweden, the Sudan and Kenya.

The Conference sessions were largely political rather than technical, but a number of panels were arranged by the Secretariat on topics such as energy in agriculture, energy and the environment, and energy and industry. As suggested by the topics and the round table formats, the discussions were diffuse and uninspiring.

The panel discussions held by the parallel Non-Government Organization Forum resulted in more lively exchanges. Only one of the panels focussed on fuelwood but others did touch on it. Participants included John Spears (Forestry Adviser of the World Bank), Keith Openshaw (a forestry economist working with the Beijer Institute), Phillip Leakey (Ministry of Environment and Natural Resources of Kenya), Marilyn Hoskins (Virginia Polytechnic), and Chandi Bhatt (the Chipko movement in India).

These discussions raised some interesting points. For example, reasons why fuelwood supply problems are proving intractable include:

... the low priority given to the basic needs of the rural sector by development planners,

... the fact that fuelwood is seen as an old fashioned fuel. Development planners feel they will be held back if wood continues to be used. (One participant referred to the creation of energy ghettos where traditional fuels would be used.)

... the need for long term financing which must compete with other priority uses for capital,

... the fact that action on a massive scale is needed,

... the fact that projects are designed from the top down with an incomplete understanding of the problem.

Elements of a possible solution were suggested:

... tree species (Prosopis) that can be grown from seed and be producing in two years. This makes planting and tending of trees cheaper, more convenient, and more immediately rewarding for the farmer,

... the World Bank's considerable success with projects where trees to be harvested for profit were planted on privately owned land,

... Kenya's reportedly considering the possibility of handing management of part of its forests over to a multinational oil company that would produce wood pellets for use as fuel,

... a tax on non-renewable energy sources that could provide a source of funds for fuelwood projects.

of draught animals for energy purposes. However, among these alternatives, fuelwood and charcoal are now in widest use and it was expected that the Conference would devote considerable attention to the fuelwood situation.

It could have been expected to give impetus to programs designed to increase fuelwood supplies in the following ways,

... by creating a forum for the exchange of experience and information about woodfuel and charcoal projects,

... by creating an awareness of the magnitude and consequences of the problem among energy planners, politicians and the public,

... by developing a plan of action with clear-cut priorities with respect to fuelwood and charcoal,

... by developing an institutional framework and adequate funding to carry out the plan of action.

The Conference in many ways was yet another test of the ability of the UN to mobilize international co-operation. The success of the Conference with respect to these various objectives for fuelwood and charcoal, and new and renewable energy sources in general, will be discussed below.

5.3 The Exchange of Experience and Information

The Conference provided a forum for dissemination of knowledge and experience in a number of ways: through the preparatory documents, through meetings at the Conference itself, and through the exhibition that was mounted by a number of countries.

In general, and with respect to fuelwood and charcoal, the preparatory documents were a mixed lot. The Technical Panel Report on Fuelwood and Charcoal was an excellent summary of the situation. However, the papers of UN organizations and the national papers dealt mainly in generalities. Little concrete information was given about activities with respect to the different energy sources. Notable exceptions were the papers of Canada, Sweden, the Sudan and Kenya.

The Conference sessions were largely political rather than technical, but a number of panels were arranged by the Secretariat on topics such as energy in agriculture, energy and the environment, and energy and industry. As suggested by the topics and the round table formats, the discussions were diffuse and uninspiring.

The panel discussions held by the parallel Non-Government Organization Forum resulted in more lively exchanges. Only one of the panels focussed on fuelwood but others did touch on it. Participants included John Spears (Forestry Adviser of the World Bank), Keith Openshaw (a forestry economist working with the Beijer Institute), Phillip Leakey (Ministry of Environment and Natural Resources of Kenya), Marilyn Hoskins (Virginia Polytechnic), and Chandi Bhatt (the Chipko movement in India).

These discussions raised some interesting points. For example, reasons why fuelwood supply problems are proving intractable include:

... the low priority given to the basic needs of the rural sector by development planners,

... the fact that fuelwood is seen as an old fashioned fuel. Development planners feel they will be held back if wood continues to be used. (One participant referred to the creation of energy ghettos where traditional fuels would be used.)

... the need for long term financing which must compete with other priority uses for capital,

... the fact that action on a massive scale is needed,

... the fact that projects are designed from the top down with an incomplete understanding of the problem.

Elements of a possible solution were suggested:

... tree species (Prosopis) that can be grown from seed and be producing in two years. This makes planting and tending of trees cheaper, more convenient, and more immediately rewarding for the farmer,

... the World Bank's considerable success with projects where trees to be harvested for profit were planted on privately owned land,

... Kenya's reportedly considering the possibility of handing management of part of its forests over to a multinational oil company that would produce wood pellets for use as fuel,

... a tax on non-renewable energy sources that could provide a source of funds for fuelwood projects.

Given the general nature of the discussion, it was impossible to discuss technical matters in detail. The session was one of general interest for those attending the Conference rather than one for people deeply involved in the issue.

The panel concluded by drawing up a resolution on fuelwood to be signed by a number of the NGO's, reiterating the importance of action on fuelwood and the need for the Conference to put more emphasis on this problem in the program of action.

The exhibition mounted by the various countries was uninspiring, consisting mainly of posters describing renewable energy projects in very general terms, with very few displays of actual hardware. However, what displays of hardware there were proved very popular. The big hits included the German and Swedish engines adapted to burn producer gas (from fuelwood). Other popular displays were the jikos (charcoal stoves) and biogas units at the Kenyan stand.

There were many people in the national delegations and representing non-governmental organizations with renewable energy expertise. However, the opportunities to formally exchange information and views were minimal. In a field like renewables where there are many small scale projects and few centers for exchange of technical information, the opportunity to formally discuss technical matters and to view the available hardware should have been maximized. From this point of view, the Conference was disappointing.

5.4 The Creation of Awareness

The Conference did result in a heightened realization of the importance of fuelwood and charcoal to almost half of the world's population, and of the growing threat to fuelwood supplies and environmental stability. Many of the national papers included sections on woodfuel and charcoal problems, illustrating concern over the situation. Speakers in the General Debate, including representatives of Sweden, Japan, Botswana, Canada, China, Sudan, India, Niger, Belgium, Kenya and Rwanda, made reference to the seriousness of the situation and the need for afforestation and reforestation, fuelwood plantations and more efficient methods of conversion and use.

Representatives of national delegations and non-governmental organizations, along with hundreds of private citizens, participated in a Fuelwood March on August 11, led by the Secretary General of the

Conference, Enrique Iglesias, and the President of the Conference and Minister of Energy of Kenya, John Henry Okwanyo.

However, while awareness of the problem was heightened by the Conference, resistance to the high profile of fuelwood and charcoal was expressed by representatives of some developing countries.

Many of the speakers from developing countries stressed their concern with obtaining adequate supplies of conventional fuels, especially oil, in the near term. An underlying attitude was most strongly expressed by the Industry Minister of Zimbabwe in his address to the Conference,

"...Zimbabwe is deeply concerned that new and renewable sources of energy should not be made the energy of the poor countries leaving the conventional energy sources to satisfy the insatiable appetites of the industrialized countries who already consume a disproportionate quantity of the world's energy resources."

Kenya's President Moi stated in his opening address that the development of the poor countries would require an ever greater deployment of energy and the the international community must ensure to those countries access to energy resources. He proposed a two tier oil price with developing countries paying a lower price for oil that would be subsidized by the industrialized countries and OPEC.

Developing countries must perform a difficult juggling act with short term needs (oil) versus long term needs (development of other forms of energy) and the needs of their modern industrialized sector (oil) versus the needs of the traditional sector that is mired in poverty (fuelwood and charcoal).

Fuelwood and charcoal are problem areas in this balancing act. While accepting the seriousness of rural energy problems, developing countries are concerned that rural energy priorities not be met at the expense of industrialization efforts. Since supplying both types of energy requires major investments, and capital is scarce in the oil-importing developing world, there are difficult decisions to be made.

There was some reluctance, therefore, on the part of Third World Countries to place too much emphasis on fuelwood and charcoal. Developing countries made clear their desire to have access to sophisticated technology that would allow the use of new and renewable

sources of energy in industrialization efforts. They also made clear the need for access to increased oil supplies in order to encourage development and industrialization.

5.5 The Plan of Action

The Conference succeeded in approving a plan of action for the development of new and renewable energy sources in which fuelwood and charcoal occupied a prominant place. While the recommended measures were not specific, given the regional nature of the problem, they could not be expected to be.

Priority for immediate action was given to: identification of fast growing species for fuelwood production, reforestation and afforestation; development of more efficient low cost stoves and charcoal production processes; widespread application of improved practices and technologies for the conservation and more effective use of natural forest resources; and establishment and acceleration of programs for large scale afforestation and reforestation and for plantations and woodlots as part of an effort to increase the rate of planting five-fold by the year 2000.

5.6 Institutional Arrangements and Financing

There was fundamental disagreement over the need for the creation of a new institution to implement and monitor the plan of action. The Group of 77 wanted multilateral funding and the designation of a new institution with its own Secretariat. The U.S. and many other industrialized nations argued that no new multilateral mechanisms were needed for transferring funds or for implementing and monitoring the plan.

Funding was equally contentious, with the Group of 77 proposing "additonal and adequate" funding, including the setting of targets. The U.S. eventually accepted the principle of additionality but refused to specify how the funds would be made available or to set target levels for funding. The U.S. stayed with its position that funding should be done through existing bilateral and multilateral aid channels, and through the private sector.

These disagreements were not resolved by the end of the Conference. The launching of the Nairobi program of action was entrusted to a Committee that will make recommendations to the 37th session of the UN General Assembly. In the words of the Prime Minister

of Jamaica, the Conference was allowed "to taper off into a device which rested on...doing only a part now of what this Conference had been called to do."

No targets were set or arrangements made for financing other than voluntary commitments. Individual countries including Canada, the Scandinavian countries, France, Italy, Japan and the USA said they intended to increase aid to develop new and renewable energy sources. Canada's commitments, as made by Pierre Trudeau, one of four heads of state attending the Conference, include:

- ... a $10 million increase over five years to IDRC in support of energy research in developing countries,
- ... initial capital of $5 million to encourage companies to adapt new technology to development needs,
- ... $25 million to alleviate a particular need of African countries, especially in the Sahel region,
- ... creation of Petro-Canada International to assist oil importing countries to exploit their own resources,
- ... support for the creation of the World Bank's Energy Affiliate.

The U.S. reiterated its opposition to the creation of a World Bank Energy Affiliate. This will have important consequences for fuelwood projects. The World Bank had proposed the expenditure of $1 billion U.S. on fuelwood projects over the next five years. However, it has available and committed only half of this amount, the other half must still be mobilized, possibly through the Energy Affiliate.

The unresolved financial issues of UNERG have special implications for fuelwood supply problems. First of all, the U.S. emphasis on market forces and the private sector to develop new renewable resources simply are not appropriate. There is a very small, localized and inadequate private sector at work in this area. The costs involved in overexploitation of fuelwood are not only individual costs, but societal costs. There is a need for long term planning. Governments must become involved directly through fiscal incentives and credit facilities to encourage the establishment of fuelwood plantations and efficient stove industries.

The amounts needed ($1 billion U.S./yr) are small when compared to other expenditures of developing countries - for instance,

the estimated cost of programs to explore for and develop petroleum resources. However, many of the countries where programs are needed are among the poorest developing countries. These countries have a very difficult time allocating resources to a critical but long term problem such as fuelwood supply when immediate problems are more pressing.

5.7 Summary

The UN Conference on New and Renewable Energy Sources undoubtedly did raise the consciousness of the public and energy planners about fuelwood supply problems. It resulted in the setting of priorities for action, including the goal of a five-fold increase in the worldwide rate of tree planting.

However, without mobilizing significant amounts of new capital, it will be impossible to implement these measures. It is now likely that the momentum generated by the Conference will be dissipated and the failure of the international system to achieve international co-operation again exposed. Many will lay the blame for this situation on the intransigent attitude of the U.S. (no new multilateral institutions or funding mechanism, and reliance on the private rather than the public sector). However, a broader look at the Conference would reveal that it was highly unlikely to succeed in its objectives of speeding the transition from oil to new and renewable energy sources.

In order for real impetus to be given to action on fuelwood and charcoal supply problems, and to the development of new and renewable energy sources, the action must be placed in the context of a total energy policy that will aid a country or region to meet overall development goals. New and renewable energy sources cannot be discussed in a vacuum, separate from issues that have a higher priority such as the current account deficits caused by oil imports.

As Maurice Strong stated at the beginning of the Conference, energy issues cannot be fragmented by source nor can they be separated from development issues.

Table 1

Summary of References in the National Papers to Fuelwood and Charcoal

Country	Estimated Current Consumption	% Total Energy Supply	Energy Plantation/SRF	Afforestation Reforestation	Pyrolysis, Conversion Efficiency	End Use Efficiency	Sawmill, Logging Waste	Gasification	Methanol
Argentina*	3 Mt								
Benin*	3.4 Mm^3		X	X		X		X	
Bolivia*	3.5 Mt								
Brazil**	20.5 Mt fuelwood	17.4							
	3.0 Mt Charcoal	2.6	X	X	X				X
Colombia*	8-12 Mm^3	30			X	X			
Canada***		3-5	X			X		X	X
China*	220 Mtce	25	X			X		X	
Dominican R.*		13	X						
Finland**	4.1 Mtoe	16	X				X	X	X
France*	3 Mtoe		X	X			X	X	X
Guinea*	1.1 Mt					X			
Guyana*			X				X	X	
Ireland**			X						
India*	133 Mt		X			X			X
Indonesia**	39 Mt	50%	X	X			X		
Kenya**	30 Mm^3	75	X	X	X	X		X	X
Nigeria*	70 Mm^3	40	X	X	X	X			X
Norway*	4.7 Mm^3	1					X	X	X
Peru	3 Mtoe						X		
Rwanda**	7.2 Mm^3							X	
Seychelles*				X					
Sierra Leone*	2.5 Mm^3		X	X		X	X		
Spain*							X		
Sudan**	13 Mt	75		X		X	X		
Surinam						X	X	X	
Sweden***	2.6 Mtoe	6.5	X	X			X	X	
Thailand*	30-40 Mm^3			X					
Tunisia*	2 Mm^3				X	X			
USA**	1.5 exajoules		X				X	X	X
Zambia*	12.8 Mm^3				X	X			

Quality of the National Papers Relative to Fuelwood and Charcoal

* poor ** some interesting material *** considerable interesting material

ANNEX